REMARKS/ARGUMENTS

The claims are 4-6. Claims 4-6 have been amended to better define the invention. In addition, the specification has been amended to replace the commas in Tables 1-3 with periods. Support for the claims may be found, *inter alia,* in the disclosure at FIG. 1. Reconsideration is expressly requested.

The disclosure was objected to because Tables 1-3 on pages 8 and 9 used commas instead of decimal points. In response, Applicants have amended the specification to correct these informalities, which it is respectfully submitted overcomes the Examiner's objections on this basis.

Claims 4-6 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for the reasons set forth on page 2 of the Office Action. In response, Applicants have amended claims 4-6 to improve their form. It is respectfully submitted that all currently pending claims fully comply with 35 U.S.C. §112, second paragraph, and Applicants respectfully request that the rejection on that basis be withdrawn.

Claims 4-6 were rejected under 35 U.S.C. §103(a) as being unpatentable over *Arnaud U.S. Patent No. 6,582,595* or *Gavrel et al. U.S. Patent No. 6,719,894* alone (claim 4) or further in view of *Abrosimov et al. RU 2140880* (claim 5) or *Abrosimov et al. RU 2146655* (claim 6). Essentially, the Examiner's position was that either *Arnaud* or *Gavrel et al. '894* discloses the method recited in the claims except for features which were either considered within the skill of the art or shown by *Abrosimov et al. '880* or *Abrosimov et al. '655*.

In response, Applicants have amended the claims to better define the invention and respectfully traverses the Examiner's rejection for the following reasons.

As set forth in claim 4 as amended, Applicants' invention provides a method for treating polluted water in which a cycle is carried out and repeated at least once at a pressure variation frequency lying within 0.01 and 0.0001 Hz. The cycle includes feeding to an electrocoagulator a dose of the polluted water, establishing an initial sub-atmospheric pressure having a minimum value of 0.01 mPa over the surface of the dose of the polluted water, and carrying out an electrocoagulation process during

which the pressure effective over the surface of the dose of the polluted water is raised gradually to a value from atmospheric pressure to 2.5 mPa. The cycle also includes withdrawing the dose of treated water, and reducing the pressure to the initial level. In this way, a stabilized electrocoagulation process is attained due to maintaining a coagulation current at a preset level so as to provide a high degree of polluted water treatment for a broad range of impurities contained therein.

Applicants believe that it would be helpful for the Examiner to consider the invention as set forth in claim 4 as amended in connection with the reason of performing electrocoagulation under the conditions recited therein. As recited in claim 4 as amended, the pressure is raised gradually as can be seen for example, in FIG. 1, which shows a pressure change plot during the electrocoagulation process. As seen from this plot, the electrocoagulation process is initiated at a minimum selected pressure Pmin and is continued with gradual rise of pressure until it reaches the maximum selected pressure Pmax, whereupon the electrocoagulation is ended. To perform the next cycle the pressure over the surface of a new portion of water is decreased to the selected value Pmin and then raised to Pmax, and so on.

As discussed in the specification, gas bubbles are removed from the surface of the electrode at a decreased pressure over the surface of water because these bubbles expand at a reduced pressure, become more buoyant and detach from the surface of the electrode. The bubbles shrink as the pressure rises so that the active area of the electrode increases and, therefore, the coagulation current intensity is stabilized.

None of the cited references discloses or suggests a method for treating polluted water as recited in claim 4 as amended, or teaches the benefits of coagulation current stabilization under conditions created for performing the electrocoagulation process that are achieved as a result of that method.

Arnaud discloses an electrocoagulation system wherein the electrocoagulation process of polluted water is performed in a hermetically sealed container at a pressure value inside the fluid above the atmospheric pressure. For example, see Column 6, lines 64-66, wherein it is stated "The system will typically operate at pressures from 10 to over 100 pounds per square inch (p.s.i.g.) above atmosphere".

Gavrel et al. '894 discloses an electrocoagulation system wherein polluted water is admitted to the reactor container with electrode plates and the pressure is raised inside the polluted fluid whereafter the electrocoagulation process is performed at an elevated pressure inside the fluid. See Column 3, lines 39-41 of *Gavrel et al. '894*, wherein it is stated "The pressure of pressurized waste fluid (101) may be between 0 to 150 psig, preferably between about 60 to 80 psig."

The pressure units provided in *Arnaud* or *Gavrel et al. '894* are suitable to measure only the excess pressure, i.e. the pressure which is by definition above atmospheric pressure. Accordingly, both *Arnaud* and *Gavrel et al. '894* disclose electrocoagulation processes performed either continuously or once at a permanently elevated pressure inside the polluted fluid selected within this range. There is no disclosure or suggestion of using pressure below the atmospheric pressure in *Arnaud or Gavrel et al. '894* and, more important, no such use is possible in principle in the *Arnaud or Gavrel et al. '894* processes because the electrocoagulation process in these references is carried out in a hermetically sealed container at a pressure inside the fluid above atmospheric pressure.

In contrast to *Arnaud and Gavrel et al. '894,* the electrocoagulation process of polluted water as recited in Applicants' claim 4, as amended, is carried out in reiterated cycles with gradual rise of pressure over the surface of a portion of water from a selected initial pressure below the atmospheric (depression) to the atmospheric pressure and above the atmospheric pressure (excess pressure).

The concept of "pressure over the surface of water " necessarily requires the presence of the water-gas phase boundary and is considered precisely as the pressure of gas over the surface of water. It is impossible to create pressure over the surface of fluid in the *Arnaud or Gavrel et al. '894* processes because no water-gas phase boundary is present.

In summary, Applicants' invention as recited in claim 4 as amended is different from anything taught by *Arnaud or Gavrel et al. '894* at least for the following reasons:

- Electrocoagulation of polluted water is carried out in reiterated cycles;

- Pressure is decreased over a portion of polluted water to a minimum value below the atmospheric pressure before the electrocoagulation is initiated; and

- The electrocoagulation process is carried out along with a continuous gradual rise of pressure over a portion of polluted water from a selected minimum to a selected maximum value equal to or above the atmospheric pressure.

As a result of these distinctions, and as discussed in Applicants' disclosure, the method for treating polluted water as recited in claim 4, as amended, provides the following advantages:

- Degassing of polluted water by creating a pressure over the surface of water below the atmospheric pressure;

- Removal of the gas bubbles from the surface of the electrode plates by creating a pressure over the surface of water below the atmospheric pressure;

- Dissolution in water being treated of gases obtained from water electrolysis (oxygen, hydrogen) instead of the removed polluted gases by increasing pressure over the surface of water in the electrocoagulation process;

- Degassing of water being treated to ensure absence of the smallest gas bubbles in water, which could prevent deposition of particles in the natural gravitational field at the stage of gravity separation; and

- Extension of the range of pressure change from a pressure below the atmospheric pressure to the atmospheric pressure and above the atmospheric pressure by gradual change of pressure in the system over the surface of polluted water.

In contrast to Applicants' invention as recited in claim 4 as amended, there is nothing disclosed or suggested in *Arnaud* or *Gavrel et al. '894,* which would lead one skilled in the art to extend the range of pressures to include pressures below the atmospheric pressure and, in principle, one following the

processes described in *Arnaud or Gavrel et al. '894* cannot implement the method recited in claim 4 as amended for the reasons discussed previously. The value range of cycle reiteration described above establishes time limits for the rate of pressure to change over the surface of water from a minimum selected value to a maximum value, and claim 4 has been amended to more clearly set forth these distinctive features.

The defects and deficiencies of the primary references to *Arnaud or Gavrel et al. '894* are nowhere remedied by the secondary references to *Abrosimov et al. '880* or *Abrosimov et al. '655*. *Abrosimov et al. '880* describes an electrocoagulation process is carried out <u>in vacuum</u> and then water separation in the gravitational field is performed at the pressure of 2-70 kPa. Accordingly, one skilled in the art would have no reason to modify either *Arnaud or Gavrel et al. '894* as suggested by the Examiner to improve separation of coagulated solid particles in polluted waters as the electrocoagulation processes in *Arnaud or Gavrel '894* are carried out at an elevated pressure <u>inside</u> the fluid, and therefore substantially differ from the electrocoagulation process according to *Abrosimov et al. '880*.

Moreover, in contrast to *Abrosimov et al. '880* (as well as *Arnaud or Gavrel et al. '894*) in Applicants' method as recited in claim 4, as amended, electrocoagulation of polluted water is carried out in reiterated cycles along with gradual rise of pressure over the surface of a portion of polluted water from a minimum pressure below the atmospheric to a maximum value equal to or above the atmospheric pressure.

As a portion of water wherein electrocoagulation has been carried out according to Applicants' process as recited in claim 4, as amended, is admitted for separation, all advantages of such treatment also have effect on the process of separation. In particular the treated water, wherein the smallest gas bubbles able to prevent deposition of particles in gravitational field, are removed, is admitted to the stage of gravity separation.

Abrosimov et al. '655 is no more relevant. According to *Abrosimov et al. '655*, the electrocoagulation process is carried out in vacuum and then water separation in the IR spectrum is performed with the specific heating power of 0.1-10.0kW/m^3. Thus, one skilled in the art would have no reason to look to *Abrosimov et al. '655* to modify the processes of either *Arnaud or*

Gavrel et al. '894 because in the primary references, the electrocoagulation process is carried out at an elevated process inside the fluid, and thus substantially differs from the electrocoagulation process according to *Abrosimov et al. '655* patent. Accordingly, it is respectfully submitted that *Abrosimov et al. '655* whether alone or in combination with *Arnaud or Gavrel et al. '894* does not render Applicants' invention as recited in claim 4 as amended obvious as one skilled in the art would have no reason to look to *Abrosimov et al. '655* to modify the method of either *Arnaud or Gavrel et al. '894* to improve treatment of polluted water.

With Applicants' method for treating polluted water with the features set forth in claim 4, as amended, electrocoagulation is brought to conformity, and therefore a portion of water admitted for separation in the electromagnetic emission IR spectrum contains no gas bubbles which ultimately improves the degree of polluted water treatment.

Accordingly, it is respectfully submitted that claim 4 as amended together with claims 5 and 6 which depend thereon are patentable over the cited references.

In summary, claims 4-6 have been amended along with the specification. In view of the foregoing, it is respectfully requested that the claims be allowed and that this case be passed to issue.

Respectfully submitted,
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Enclosure: Copy of Petition for one month extension of time

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on February 2, 2007.

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